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RA 06-38 PROPOSER INFORMATION PAMPHLET

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This announcement will be posted directly to www.fbo.gov and www.grants.gov. The following information is for those wishing to respond to the announcement.

Information Theory for Mobile Ad-Hoc Networks for Young Investigators (ITMANET-YI), SOL RA 06-38, Proposals Due: Initial Closing: June 28, 2006, at 12:00 noon ET. Final Closing: May 1, 2007, at 12:00 noon ET. Technical point of contact: J. Christopher Ramming, DARPA/IPTO; EMAIL itmanet-solicitation@darpa.mil; FAX: (703) 741-7804.

GENERAL INFORMATION

This notice, in conjunction with the RA 06-38 FBO Announcement, constitutes the total Research Announcement (RA). No additional information is available, nor will a formal Request for Proposal (RFP) or additional solicitation (other than that referenced below in section "Dual solicitation strategy") regarding this announcement be issued. Requests for same will be disregarded.

A. Dual solicitation strategy

This RA is being released in conjunction with a Broad Agency Announcement BAA 06-37. The primary difference between this RA and the BAA is that the RA targets a specific community of "Young Investigator" proposers whereas the BAA is open to a wider range of proposers (see Section C - Proposer Eligibility below). Interested parties should refer to the BAA FBO Announcement and PIP at
http://www.darpa.mil/ipto/Programs/itmanet/index.htm

Proposals to RA 06-38 are eligible for consideration under the more general competition of BAA 06-37. To avoid duplicative submissions, RA proposers wishing to submit to the BAA as well must indicate their intent as part of their cover sheet generation process (see Section D – Submission process below).

B. Web site, workshop and ongoing Q&A

Questions and answers may be posted at the program solicitation web page (see "administrative addresses" below). In addition, the proceedings of a workshop related to this solicitation are available at that URL. A Frequently Asked Questions (FAQ) list may be provided at that URL.

C. Proposer eligibility

DARPA has determined that it is in the national interest to support a new generation of researchers who will become deeply familiar with technical issues of strategic importance to the Department of Defense. Therefore, this solicitation is targeted specifically at the community of "Young Investigators". For purposes of this RA, a "Young Investigator" is defined to be a researcher who meets all of the following criteria:

- Holds a tenure-track faculty position at a U.S. institution of higher learning;
- Is not tenured as of the date this proposal is due, i.e. June 28, 2006;
- Was awarded a PhD no earlier than January 1, 1998; and
- Received a first appointment as faculty member no earlier than January 1, 1998.

Given this definition, the proposal teams that are eligible to apply to this RA comprise teams of grant institutions in which all key individuals meet the Young Investigator

definition. The proposal team shall include only individuals meeting the above criteria. The proposal team shall be in an organizational structure that allows for efficient communication with DARPA and performance of proposal team responsibilities. It is recognized that the proposal team may utilize non-proposal team members as subawardees for certain aspects of the proposed work. However, such subawardee duties shall not include any such areas that could be performed by a proposal team member.

Historically Black Colleges and Universities (HBCUs) and Minority Institutions (MIs) are encouraged to submit proposals and join others in submitting proposals. However, no portion of this announcement will be set aside for HBCU and MI participation due to the impracticality of reserving discrete or severable areas of this research for exclusive competition among these entities.

D. Submission process

Proposals not meeting the format described in this pamphlet may not be reviewed. Proposals MUST be submitted to DARPA in hard copy. Any submissions sent via fax or email will be disregarded. Responding to this announcement requires completion of an online Cover Sheet for each Proposal prior to submission. To do so, the offeror must go to **https://csc-ballston.dmeid.org/baa/index.asp?RAid=06-38** and follow the instructions there. Each offeror is responsible for printing the Confirmation Sheet and attaching it to every proposal copy. If an offeror intends to submit more than one Proposal, a unique UserId and password must be used in creating each Cover Sheet.

All proposals must include the following:

- One (1) original of the full proposal including the Confirmation Sheet
- Four (4) copies of the full proposal including the Confirmation Sheet
- Two (2) electronic copies of the full proposal. These electronic copies must be:
    - On a CD
    - In PDF or Microsoft Word for IBM-compatible format
    - clearly labeled with RA 06-38, proposer organization, proposal title (short title recommended) and "Copy ___ of 2"

DARPA will acknowledge receipt of complete submissions and assign control numbers that should be used in all further correspondence regarding proposals.

The full proposal (original and designated number of hard and electronic copies) must be submitted in time to reach DARPA by 12:00 PM (ET) June 28, 2006 (initial closing), in order to be considered during the initial evaluation phase. However, RA 06-38 (ITMANET-YI) will remain open until 12:00 NOON (ET) May 1, 2007. Thus, proposals may technically be submitted at any time from issuance of this announcement through 12:00 NOON (ET) May 1, 2007. However, proposers should keep in mind that while any proposals submitted after the June 28, 2006 deadline may be evaluated by the Government, the likelihood of funding such proposals is greatly reduced.

Failure to comply with the submission procedures may result in the submission not being evaluated.

Restrictive notices notwithstanding, proposals may be handled for administrative purposes by support contractors. These support contractors are prohibited from competition in DARPA technical research and are bound by appropriate non-disclosure requirements. Input on technical aspects of the proposals may be solicited by DARPA from non-Government consultants /experts who are strictly bound by the appropriate non-disclosure requirements.

However, non-Government technical consultants/experts will not have access to proposals that are clearly labeled on proposal documentation by their offerors as "Government Only". Use of non-government personnel is covered in FAR 37.203(d).

It is the policy of DARPA to treat all proposals as competitive information and to disclose their contents only for the purpose of evaluation. No proposals will be returned. Upon completion of the source selection process, the original of each proposal received will be retained at DARPA and all other copies will be destroyed.

E. RA correspondence and administrative addresses

DARPA will use electronic mail for all technical and administrative correspondence regarding this RA, with the exception of selected/not-selected notifications. The official notifications will be sent via US mail to the Technical POC identified on the proposal coversheet.

Administrative, technical or contractual questions must be received by April 20, 2007, at 12:00 noon ET, and should be sent via e-mail to itmanet- solicitation@darpa.mil. If e-mail is not available, please fax questions to (703) 741-7804 Attention: ITMANET-YI Solicitation. All requests must include the name, email address, and phone number of a point of contact.

Solicitation Web site and Electronic File Retrieval:
http://www.darpa.mil/ipto/programs/itmanet/index.htm.

Postal address: DARPA/IPTO, ATTN: RA 06-38, 3701 N. Fairfax Drive, Arlington, VA 22203-1714

For hand deliveries, the courier shall deliver the package to the DARPA Visitor Control Center at the address specified above. To ensure proper handling, the outer package, as well as the cover page of the proposal, must be marked "IPTO RA 06-38."

PROGRAM OBJECTIVES AND DESCRIPTION

The objective of the Information Theory for Mobile Ad-Hoc Networks (ITMANET) program is to generate and exploit superior theoretical insights concerning the design,

deployment, and operation of a new generation of wireless mobile networks. To achieve this objective, a central challenge problem has been devised: to close a longstanding open problem concerning the capacity limits of Mobile Ad-hoc NETworks (MANETs). The central program thesis is that a novel kind of information theory --- one powerful enough to address the challenge problem --- will have wide-ranging practical consequences in the long term. Specifically, it is believed that capacity understanding in relation to necessary trades has immediate application, and moreover that new architectures and protocols will emerge as a side-effect of developing the techniques needed for capacity understanding. Residual knowledge generated by researchers who fully engage in this challenge problem will serve the national interest in progress toward more ubiquitous, reliable, and trustworthy communication systems.

A crowning achievement of information theory has been to characterize the upper capacity bounds of an additive white Gaussian noise channel; similar insight is sought into the limitations of future networks. However, unlike Shannon's source-channel-sink capacity formulation, the desired formulation will take into account not just bandwidth, signal, and noise levels but rather a wider range of dimensions including energy, latency, computational complexity, space complexity, mobility, topology, protocol overhead, security, node heterogeneity, side information, application characteristics (including utility, priority, requirements, and internal topology), network hierarchy, RF channel characteristics, and traffic characteristics (including bursty, heterogeneous, and prioritized source types). The desired formulation would characterize constants and bounds both asymptotically and for specific network instances. Additionally, unlike present research results which are based on specific technology choices (multihop routing, scheduling with spatial re-use, successive interference cancellation, etc.) the desired results would provide technology-independent guidance for future research much as the AWGN capacity formula has provided targets for wireless coding and modulation schemes. Finally, unlike the existing formulation which does not take into account the costs and benefits of activities such as routing, the desired formulation would address the full range of network activities necessary to sustain user throughput.

Another crowning achievement of present information theory has been the source-channel separation theorem with its substantial architectural implications. If similar separation theorems can be developed for MANETs, we may be able to discern a theoretically motivated network stack that will be more appropriate for MANETs than present wireline-oriented architectures.

Moreover, in the same way that Shannon's work ultimately resulted in Turbo codes and their variants, it is anticipated that Information Theory for MANETs will ultimately lead to novel high-performance MANET protocols. For instance, researchers are investigating store-carry-forward protocols for disruption-tolerance in mobile networks; researchers are also investigating network coding protocols for capacity improvement. Since both investigations exploit memory at the routing nodes, it is natural to expect that a unified theory of MANET capacity would reveal a deep relationship between these two concepts leading to a unified protocol. As a second example, researchers have suggested technologies such as successive interference cancellation (SIC) that can involve

cooperative diffusion of information; network coding may again prove deeply related since practical protocols may involve a similar cooperative diffusion. As a third example, emerging physical smart antenna technologies offer degrees of freedom concerning interference cancellation, MIMO, and beam-forming; the relationship between such choices and specific higher-layer protocols remains an open question that could be informed by information theory. Fourth, it is unclear to what extent hierarchy, heterogeneity, and multi-channel approaches should play into an overall wireless network deployment, and the desired theory may provide new insights for large-scale network design and deployment. Fifth, security concepts (encryption, authentication, multilevel security overlays) need to be factored into network designs, and there may be implications for security that arise from better information theory. This enumeration of desirable design insights is certainly not exhaustive; even posing the right questions requires deeper insight than is presently available.

In sum, there are many questions that may be addressed as a byproduct of better information theory for mobile wireless networks, but the foundations need to be created first. To reiterate, the hypothesis of ITMANET is that a specific challenge problem --- better understanding of MANET capacity (and by implication other) limits --- will have wide-ranging actionable implications. Therefore, DARPA/IPTO is hereby soliciting proposals for research that will answer the following questions:

- What are the capacity (and other) performance bounds of mobile ad-hoc networks? (Note: For purposes of this solicitation, the term MANET is not intended to convey conventional limitations such as a focus on flatly routed networks comprising homogeneous nodes. Rather, the term is meant only to suggest the myriad complications arising from future multihop wireless networks incorporating elements of mobility and wireless technology.)
- How is capacity related to other dimensions of MANET performance?
- What architectures and protocols will achieve MANET performance bounds?

PROGRAMMATICS

A. Program scope

Proposed research should investigate innovative approaches and techniques that lead to or enable revolutionary advances in the understanding or discovery of key tenets and principles of information theory and mobile ad hoc networks. Specifically excluded is research that primarily results in minor evolutionary improvement to the existing state of practice, that focuses on special-purpose systems, or that focuses on narrow applications.

B. Period of performance, acquisition plan, funding, and number of awards

Proposals may span four-and-a-half (4.5) years. For planning purposes, proposers should anticipate a start date of September 1, 2006.

DARPA is soliciting the necessary program research through two mechanisms: a Broad Agency Announcement BAA 06-37 and a Research Announcement RA 06-38 (see Section A - Dual solicitation strategy and Section C - Proposer Eligibility above). DARPA anticipates that the program will be funded in the 6.1 budget category at a maximum of $13,500,000 across all awards resulting from the two solicitations.

DARPA anticipates that two proposals will be selected for negotiation: one from each solicitation. However, in any event the Government reserves the right to select for negotiation all, some, one, or none of the proposals received in response to this solicitation and to make awards without discussions with offerors. The Government also reserves the right to conduct discussions if the Source Selection Authority later determines them to be necessary. Proposals identified for negotiation may result in a grant, cooperative agreement, or other transaction depending upon the nature of the work proposed, the required degree of interaction between parties, and other factors. If warranted, portions of resulting awards may be segregated into pre-priced options. Additionally, DARPA reserves the right to award without discussions, and to accept proposals in their entirety or to select only portions of proposals for award. In the event that DARPA desires to award only portions of a proposal, negotiations may be opened with that offeror. If the proposed effort is inherently divisible and nothing is gained from the aggregation, proposers should consider submitting it as multiple independent efforts.

C. Program phasing

In terms of award structure, proposers should anticipate a base agreement covering 18 months followed by three outyear option periods of 12 months each.

However, DARPA will not impose an a-priori program phasing on the technical structure for the four-and-a-half (4.5) year ITMANET program span; rather, **proposers are required to define the structure of their effort, including phasing, milestones, and deliverables,** keeping in mind that formal reviews will be required approximately every six (6) months.

For example, proposers might expect to shift in an orderly fashion from theory development toward theory exploitation as the program progresses, or to focus on different aspects of the problem during each of the six month program periods, each of which might have different objectives. The expected outcome of each six month period should be described in the proposal itself. Given the nature of research, DARPA understands that more detail will likely be available for the first eighteen months than for outyears.

D. Evidence of forward progress ("metrics")

It is expected that substantial progress toward the program objectives will be evidenced at each review, and that progress will be evaluated qualitatively at each six-month review according to the following criteria. Ongoing program support will be contingent upon satisfactory reviews.

- Did researchers carry out their constructive plan and fulfill the objectives, milestones, and deliverables identified as identified in the proposal and as refined in the previous review? If not, was there an appropriate technical reason for the divergence? Rationale for criterion: a well-thought-out research agenda complements serendipity.
- Are major breakthroughs in the Information Theory of MANETS being developed? Rationale for criterion: non-incremental progress is the desired outcome of the program.
- Is there evidence of substantive interactions across networking, information theory, and any other relevant disciplines? Rationale for criterion: the problem is inherently multidisciplinary, and is not likely to be solved by researchers in a single specialty.
- Is the effort broadly influencing the research agenda in all relevant fields? Rationale for criterion: an important aspect of the program is to generate a research agenda that broadly inspires the larger community.
- To what extent is the initiative generating actionable insights, or to what extent is it on track to do so? Rationale for criterion: problem understanding should ultimately be of a constructive nature.

E. Meeting and travel requirements

There will be a program kickoff followed by biannual Principal Investigator (PI) meetings. All key individuals are required to participate in the kickoff and PI meetings. For planning and costing purposes, it should be anticipated that two-day PI meetings will be held on a rotating basis on the West Coast (nominally San Francisco), Midwest (nominally Chicago), Southeast (nominally Miami), and East Coast (nominally Washington, DC). Performers should also anticipate periodic site visits at the program manager's discretion.

F. Reporting requirements

The Award Document for each proposal selected and funded will contain a mandatory requirement for submission of DARPA/IPTO Quarterly Status Reports and an Annual Project Summary Report. These reports will be electronically submitted by each awardee under this announcement via the DARPA/IPTO Technical – Financial Information Management System (T-FIMS). The T-FIMS URL will be furnished by the government upon award. Detailed data requirements can be found in the Data Item Description (DID) DI-MISC-81612A available on the Government's ASSIST database http://assist.daps.dla.mil/quicksearch/

Each performer will also be required to submit periodic reports on invention disclosure, election of title, and filing of patent applications.

There may also be additional reporting requirements for grants and cooperative agreements. DARPA's Contracts Management Office (CMO) website

(http://www.darpa.mil/cmo/pages/modelgrantagreement.htm) contains information about model grant and cooperative agreement terms and conditions.

In addition, it is anticipated that if multiple awards are made, each performer team will be required to provide a constructive technical analysis of progress made by the other team(s) following each PI meeting (informal analysis) and at yearly intervals (formal analysis based on the Annual Project Summary Report). This collegially-intended "red-teaming" will provide a basis of dialogue across projects.

G. Human use

Proposals selected for award are required to comply with provisions of the Common Rule (32 CFR 219) on the protection of human subjects in research (http://www.dtic.mil/biosys/downloads/32cfr219.pdf) and the Department of Defense Directive 3216.2 (http://www.dtic.mil/whs/directives/corres/html2/d32162x.htm). All proposals that involve the use of human subjects are required to include documentation of their ability to follow Federal guidelines for the protection of human subjects. This includes, but is not limited to, protocol approval mechanisms, approved Institutional Review Boards, and Federal Wide Assurances. These requirements are based on expected human use issues sometime during the entire length of the proposed effort.

For proposals involving "greater than minimal risk" to human subjects within the first year of the project, performers must provide evidence of protocol submission to a federally approved IRB at the time of final proposal submission to DARPA. For proposals that are forecasted to involve "greater than minimal risk" after the first year, a discussion on how and when the proposer will comply with submission to a federally approved IRB needs to be provided in the submission. More information on applicable federal regulations can be found at the Department of Health and Human Services – Office of Human Research Protections website (http://www.dhhs.gov/ohrp/).

Any aspects of a proposal involving human use should be specifically called out as a separate element of the statement of work and cost proposal to allow for independent review and approval of those elements.

H. Security classification

Security classification guidance on a DD Form 254 (DoD Contract Security Classification Specification) will not be provided at this time. DARPA does not anticipate that any aspect of this program will be classified, and does not encourage classified proposals in response to this announcement. However, after reviewing incoming proposals, if a determination is made that contract award may result in access to classified information, a DD Form 254 will be issued upon contract award. If you choose to submit a classified proposal you must first receive the permission of the Original Classification Authority to use their information in replying to this announcement.

I. Publication approval

DARPA anticipates that work for this program is to be funded within DOD budget category 6.1. This means that research performed under this program is considered contracted fundamental research; therefore, public releases of information about such research are not subject to prior Government review. The definition of CONTRACTED FUNDAMENTAL RESEARCH is contained in DOD Instruction 5230.27 and can be found at http://www.dtic.mil/whs/directives/corres/pdf2/i523027p.pdf . Public release of information about research performed under circumstances other than those described above is subject to prior government review, according to the procedures available at http://www.darpa.mil/tio.

PROPOSAL PREPARATION AND FORMAT

The proposal shall be delivered in two volumes, Volume 1 (technical proposal) and Volume 2 (cost proposal). The technical volume should include sections I, II, and optionally III as described below. The cost volume should include section IV as described below.

Proposals shall include the following sections, each starting on a new page (where a "page" is 8-1/2 by 11 inches with type not smaller than 12 point) and with text on one side only. Apart from what is described in Section III, the submission of other supporting materials along with the proposal is strongly discouraged. Individual elements of Sections I and II of the proposal shall not exceed the total of the maximum page lengths for each section as shown in braces { } below.

Section I. Administrative

A. {1 Page} Announcement Confirmation Sheet

The confirmation sheet (described under “Submission Process” of this announcement) will contain the following information:

- Announcement number;
- Technical topic area;
- Proposal title;
- Technical point of contact including: name, telephone number, electronic mail address, fax (if available) and mailing address;
- Administrative point of contact including: name, telephone number, electronic mail address, fax (if available) and mailing address;
- Summary of the costs of the proposed research, including total base cost, estimates of base cost in each year of the effort, estimates of itemized options in each year of the effort, and cost sharing if relevant;
- Offeror’s type of entity, selected from among the following categories: "HBCU," "MI," or "OTHER EDUCATIONAL";

- If the proposal is to be viewed only by Government personnel, a statement to that effect must be affixed to the coversheet.
- Indication of whether or not submission should also be considered as part of BAA 06-37.

B. {1 Chart} PowerPoint summary chart

Section I should include a one slide summary of the proposal in PowerPoint that effectively and succinctly conveys the main objective, key innovations, expected impact, and other unique aspects of the proposal

C. {No page limit} Table of contents

Section I should include a table of contents for the overall technical volume.

Section II. Detailed Proposal Information

This section provides the detailed discussion of the proposed work necessary to enable an in-depth review of the specific technical and managerial issues. Page-counts listed in braces are maximums.

A. {1 Page} Innovative claims for the proposed research.

This page is the centerpiece of the proposal and should succinctly describe the unique proposed approach and contributions.

B. {2 Page} Proposal Roadmap

The roadmap provides a top-level view of the content and structure of the proposal. It contains a synopsis for each of the roadmap areas defined below, which should be elaborated elsewhere. It is important to make the synopses as explicit and informative as possible. The roadmap must also cross-reference the proposal page number(s) where each area is elaborated. The required roadmap areas are:

a. Main goals of the proposed research

The proposer is expected to summarize their interpretation of the ITMANET challenge problem and what they believe their effort will accomplish. The detailed proposal is expected to clearly address the following questions:

- What problem formulation will be addressed, in terms of capacity definition(s) and problem dimensions considered?
- Apart from capacity and other MANET limitations, which tractable information-theoretic questions or corollaries will be addressed within the time span of the program?

b. Expected actionable insights

To the extent that successful MANET capacity understanding will lead to architectural and design principles for future networks, the specific anticipated benefits of the proposed research should be identified succinctly here and elaborated in the detailed technical approach section. Candidate areas of impact might include, but are neither required nor limited to:

- Analysis of the "headroom" available for further progress relative to current protocols.
- Understanding the theoretical basis of a relationship between emerging technologies such as network coding, successive interference cancellation, multi-hop routing, MIMO, beam forming, encryption.
- Invention of new wireless networking architectures, protocols and "technologies" that exploit hitherto-unimagined areas of the theoretical capacity limits.
- Understanding the implications of resulting theory for best practices in network planning, deployment, and operations.

c. Critical theoretical barriers

Proposers are expected to decompose the challenge problem and identify the primary theoretical obstacles that will need to be addressed in order to achieve success. The detailed proposal is expected to clearly address the following questions:

- What intermediate challenges need to be answered to achieve the result?
- What are the dependencies among the intermediate challenges?

d. Theoretical enablers

The detailed proposal should clearly address the following question:

- Specifically what enabling insights and results will allow the proposer to make progress when the problem has proved over-challenging heretofore? (Where suitable, the detailed proposal should cite relevant quantitative experimental results, proofs, etc.)
- What balance between completeness of theory and utility of theory will the project achieve, and how?

e. Main elements of the proposed technical approach

The detailed proposal should address questions including:

- What are the mainline research thrusts?
- What are the interactions between these research thrusts?
- What intermediate results are expected?

f. Basis of confidence

Rationale that builds confidence that the proposed approach will overcome the technical barriers. Given that critical theoretical barriers, enablers, and proposed approach must be acted on by the proposal team, the detailed proposal should address questions including:

- What is the constructive plan for engaging in the mainline research thrusts?
- What timeline is proposed for investigating subquestions?
- What are the alternative paths to success?
- Why is this particular team well-positioned to overcome the identified technical barriers and how will that be done?
- What is the overall management plan and how will the team work productively together?

g. Risk if work is not done

If DARPA were not to fund the proposed effort, what would be lost? In addition to lost technical opportunities, proposers may wish to consider whether the nature of the proposal is such that it requires large-scale sustained funding of a substantial team in contrast to the separate funding of individual smaller-scale efforts. If the proposed effort is inherently divisible and nothing is gained from the aggregation, proposers should consider submitting it as multiple independent efforts. ITMANET was designed in hopes of eliciting viable intense, focused, and sustained efforts rather than a host of incremental or narrow efforts.

h. Nature and description of end results to be delivered to DARPA

In what form will results be developed and delivered to DARPA and the scientific community? Note that DARPA encourages experiments, simulations, specifications, proofs, etc. to be documented and published to promote progress in the field. Proposers should specify both final and intermediate products.

i. Cost and schedule of the proposed effort

For costing purposes, proposers should use the calendar year beginning January 1. Note that awards and contracting are expected to be complete by September 1, 2006.

j. Criteria for objectively evaluating progress on a six month basis

Proposers should identify any intermediate results, achievements, and deliverables that are expected to serve as markers of progress. Please see Sections C and D under "Programmatics" above.

C. {2 Pages} Detailed Research Objectives

- **Problem Description.** Describe the problem formulation addressed by this research project, including definitions of capacity and other limits, problem dimensions addressed, nature of networks under study, and form of the expected results.
- **Research Goals.** Identify specific, objectively defined research goals and subgoals of this project. Identify expected knowledge advances from this research.
- **Expected Impact.** Describe expected impact of the research project, if successful. Identify new networking capabilities and insights for network design and implementation that are enabled by this research. Characterize the influence this work is expected to have on the relevant contributing research communities.

D. {12 Pages} Detailed Technical Proposal

Provide detailed description of technical approach that will be used in this project to achieve research goals. This section will elaborate on many of the topics identified in the proposal road map and will serve as the primary expression of the proposers' scientific and technical ideas.

E. {2 Pages} Experimentation Plans

Offerors should identify any planned experiments to test their hypotheses and must be willing to work with other awardees in order to develop joint experiments and validation. Offerors should expect to participate in teams and workshops to provide specific technical background information to DARPA, attend a kickoff and semiannual Principal Investigator (PI) meetings, and participate in other site and coordination meetings via teleconference or Video Teleconference (VTC) as needed. If needed, funding to support experimentation efforts should be included in technology project bids.

F. {3 Pages} Comparative related work analysis

Describe and analyze state-of-the-art results, approaches, and limitations within the context of the problem area addressed by this research. Demonstrating problem understanding requires not just the enumeration of related efforts; rather, related work must be compared and contrasted to the proposed approach.

G. {3 Pages} Overall Statement of Work

Written in plain English, the SOW must outline the scope of the effort and cite specific tasks to be performed, references to specific subawardees if applicable, and specific awardee requirements. The statement of work for the first year is expected to be substantially more detailed than the statement of work for out-years, but the out-year work elements must be broadly characterized by the SOW.

H. {3 Pages} Teaming and Detailed Individual Effort Descriptions

Provide an argument that the team size and composition are both necessary and sufficient to meet the program objectives. Provide detailed task descriptions, costs, and interdependencies for each individual effort and/or subawardee. To the extent that graduate students and postdocs are involved in individual efforts, describe their role and contribution.

I. {2 Pages} Deliverables Description

List and provide detailed description for each proposed deliverable, including receiving organization and expected delivery date for each deliverable. Include in this section all proprietary claims to results, prototypes, or systems supporting and/or necessary for the use of the research, results, and/or prototype. If there are no proprietary claims, this should be stated. Any proprietary claims on the research results will negatively affect the "DARPA Relevance" evaluation criterion (see the Proposal Evaluation Criteria section below). The offeror must submit a separate list of all technical data or computer software that will be furnished to the Government with other than unlimited rights (see section Q below).

J. {3 Pages} Management Plan

Describe formal teaming agreements that are required to execute this program, a brief synopsis of all key personnel, and a clearly defined organization chart for the program team (prime awardee and subawardees, if any). Information in this section must cover the following information:

- Programmatic relationship of team members;
- Unique capabilities of team members;
- Task responsibilities of team members;
- Teaming strategy among the team members;
- Key personnel along with the amount of effort to be expended by each person during each year; and
- Government role in project, if any

K. {1 Page} Schedule Graphic

Provide a graphic representation of quarterly project schedule including detail down to the individual effort level. This should include but not be limited to, a multi-phase development plan, which demonstrates a clear understanding of the proposed research; and a plan for periodic and increasingly robust experiments over the project life that will show applicability to the overall program concept. Show all project milestones. Research dependencies and costs should be visible in the chart. Use absolute designations for all dates. The first year's efforts should be substantially detailed.

L. {2 Pages} Theory Transition and Theory Transfer Targets and Plans

As an alternative to discussion about "technology transition", discuss anticipated transition of theory into practice. Identify specific technologies that will benefit from the developed theory. If possible, specify anticipated timeframes for transition or application.

M. {No page limit} Personnel, Qualifications, and Commitments

List key personnel showing a concise summary of their qualifications, discussion of proposer's previous accomplishments and work in this or closely related research areas. Indicate the level of effort in terms of hours to be expended by each person during each contract year and other (current and proposed) major sources of support for them and/or commitments of their efforts. DARPA expects all key personnel associated with a proposal to make substantial time commitment to the proposed activity and the proposal will be evaluated accordingly.

Include a table of key individual time commitments as follows:

Key Individual	**Project**	**Pending/Current**	**2006**	**2007**	**2008**	**2009**	**2010**
Jane Doe	ITMANET	Proposed	XXX hours	YYY hours	ZZZ hours	UUU hours	WWW hours
	Project 1	Current	1 hour	2 hours	n/a	n/a	n/a
	Project 2	Pending	0 hours	100 hours	100 hours	n/a	n/a
John Deer	ITMANET	Proposed	etc.				

N. {1 Page} Facilities

Description of the facilities that would be used for the proposed effort. If any portion of the research is predicated upon the use of Government Owned Resources of any type, the offeror shall specifically identify the property or other resource required, the date the property or resource is required, the duration of the requirement, the source from which the resource is required, if known, and the impact on the research if the resource cannot be provided. If no Government Furnished Property is required for conduct of the proposed research, the proposal shall so state.

O. {No page limit} Organizational Conflict of Interest Affirmations and Disclosure

Awards made under this announcement may be subject to the provisions of the Federal Acquisition Regulation (FAR) Subpart 9.5, Organizational Conflict of Interest. All offerors and proposed subawardees must affirmatively state whether they are supporting any DARPA technical office(s) through an active award or subaward. All affirmations

must state which office(s) the offeror supports, and identify the prime award number. Affirmations should be furnished at the time of proposal submission. All facts relevant to the existence or potential existence of organizational conflicts of interest, as that term is defined in FAR 2.101, must be disclosed, organized by task and year. This disclosure shall include a description of the action the Awardee has taken, or proposes to take, to avoid, neutralize, or mitigate such conflict. **Important note: if the offeror does not comply with this disclosure requirement, the proposal will be rejected.**

P. {No page limit} Intellectual Property

(a) Non-FARS/DFARS IP restrictions: (Technical Data and Computer Software)

Proposers responding to this solicitation requesting a Grant, Cooperative Agreement, Technology Investment Agreement, or Other Transaction for Prototype shall follow the applicable rules and regulations governing these various award instruments, but in all cases should appropriately identify any potential restrictions on the Governments use of any Intellectual Property contemplated under those award instruments in question. This includes both Noncommercial Items and Commercial Items. Although not required, proposers may use a format similar to that described in Paragraphs 3.4.1 and 3.4.2 herein. PROPOSERS ARE ADVISED THAT OFFERS CONTAINING RESTRICTIONS ON INTELLECTUAL PROPERTY ARE BY NATURE LESS FAVORABLE AND VALUABLE TO THE GOVERNMENT. RESTRICTIONS WILL BE CONSIDERED IN THE EVALUATION PROCESS. If no restrictions are intended, then the proposer should state "NONE."

(b) Patent dependencies

Please include documentation proving your ownership of or possession of appropriate licensing rights to all patented inventions (or inventions for which a patent application has been filed) that will be utilized under your proposal for the DARPA program. If a patent application has been filed for an invention that your proposal utilizes, but the application has not yet been made publicly available and contains proprietary information, you may provide only the patent number, inventor name(s), assignee names (if any), filing date, filing date of any related provisional application, and a summary of the patent title, together with either: 1) a representation that you own the invention, or 2) proof of possession of appropriate licensing rights in the invention. Please also provide a good faith representation that you either own or possess appropriate licensing rights to all other intellectual property that will be utilized under your proposal for the DARPA program. If you are unable to make such a representation concerning non-patent related intellectual property, please provide a listing of the intellectual property to which you do not have needed rights, and provide a detailed explanation concerning how and when you plan to obtain these rights.

Section III. {No page limit} Additional Technical Information

A bibliography of relevant technical papers and research notes (published and unpublished) that document the technical ideas, upon which the proposal is based, may be included in the proposal submission. Provide one set for the original full proposal and one set for each of the full proposal hard copies. Please note: The materials provided in this section, and submitted with the proposal, will be considered for the reviewer's convenience only and not considered as part of the proposal for evaluation purposes. For the reviewer's convenience, this section may also include up to 3 relevant papers, published or unpublished.

Section IV. {No page limit} Cost proposal

The cost volume should be a separate document from the technical and management volume comprising sections I through III.

A. Cover sheet

- Name and address of proposer (include zip code);
- Name, title, and telephone number of proposer's point of contact;
- Award instrument requested: cost-plus-fixed-fee (CPFF), cost-contract--no fee, cost sharing contract--no fee, or other type of procurement contract (specify), grant, agreement, or other award instrument;
- Place(s) and period(s) of performance;
- Funds requested from DARPA for the Base Effort, each option and the total proposed cost; and the amount of cost share (if any);
- Name, mailing address, telephone number and Point of Contact of the proposers cognizant government administration office (i.e., Office of Naval Research/Defense Contract Management Agency (DCMA)) (if known);
- Name, mailing address, telephone number, and Point of Contact of the Proposer's cognizant audit office (if known);
- Any Forward Pricing Rate Agreement, other such Approved Rate Information, or such other documentation that may assist in expediting negotiations (if available);
- Contractor and Government Entity (CAGE) Code,
- Dun and Bradstreet (DUN) Number;
- North American Industrial Classification System (NAICS) Number [NOTE: This was formerly the Standard Industrial Classification (SIC) Number]; and,
- Taxpayer Identification Number (TIN).
- All subawardee proposal backup documentation to include items a. through l. above, as is applicable and available).

B. Detailed cost breakdown

Total program cost broken down by month and calendar year (beginning January 1) and Base and Options. Where the effort consists of multiple phases that could reasonably be partitioned for purposes of funding, these should be identified as options with separate cost estimates for each.

Cost breakdown categories:

- Direct Labor – Individual labor category or person, with associated labor hours and unburdened direct labor rates;
- Indirect Costs – Fringe Benefits, Overhead, General and Administrative Expense, Cost of Money, etc. (Must show base amount and rate);
- Travel – Number of trips, number of days per trip, departure and arrival destinations, number of people, etc.
- Subaward – A cost proposal as detailed as the proposer's cost proposal will be required to be submitted by the subawardee. The subawardee's cost proposal can be provided in a sealed envelope with the proposer's cost proposal or will be requested from the subawardee at a later date;
- Consultant – Provide consultant agreement or other document which verifies the proposed loaded daily/hourly rate;
- Materials – Should be specifically itemized with costs or estimated costs. An explanation of any estimating factors, including their derivation and application, shall be provided. Please include a brief description of the proposer's procurement method to be used;
- Other Direct Costs – Should be itemized with costs or estimated costs. Backup documentation should be submitted to support proposed costs.
- Costs of major program tasks and major cost items by year and month;
- Supporting cost and pricing information.

Supplementary information should be provided in sufficient detail to substantiate the summary cost estimates above. Include a description of the method used to estimate costs and supporting documentation. Provide the basis of estimate for all proposed labor rates, indirect costs, overhead costs, other direct costs and materials, as applicable.

C. {No page limit} Government Furnished Property

Awardees requiring the purchase of information technology (IT) resources as Government Furnished Property (GFP) MUST attach to the submitted proposals the following information:

- A letter on corporate letterhead signed by a senior corporate official and addressed to Mr. J. Christopher Ramming, Program Manager, DARPA/IPTO, stating that you either can not or will not provide the information technology (IT) resources necessary to conduct the said research.

- An explanation of the method of competitive acquisition or a sole source justification, as appropriate, for each IT resource item.
- If the resource is leased, a lease/purchase analysis clearly showing the reason for the lease decision.
- The cost for each IT resource item.

PROPOSAL EVALUATION CRITERIA

It is the policy of DARPA to ensure impartial, equitable, comprehensive proposal evaluations and to select the source (or sources) whose offer meets the Government's technical, policy, and programmatic goals. The primary basis for selecting proposals for acceptance shall be technical, importance to agency programs, and fund availability. In order to provide the desired evaluation, qualified Government personnel will conduct reviews and (if necessary) convene panels of experts in the appropriate areas.

Proposals will not be evaluated against each other, since they are not submitted in accordance with a common work statement. DARPA's intent is to review proposals as soon as possible after they arrive; however, proposals may be reviewed periodically for administrative reasons. For evaluation purposes, a proposal is the document described in PROPOSAL PREPARATION AND FORMAT Section I, Section II, and Section IV (see above.) Other supporting or background materials (Section III) submitted with the proposal will be considered for the reviewer's convenience only and not considered as part of the proposal.

Evaluation of proposals will be accomplished through a review of each proposal using the following criteria, which are listed in descending order of relative importance:

OVERALL SCIENTIFIC AND TECHNICAL MERIT. The objective of this criterion is to establish the technical worthiness of the proposed effort. Evaluation will consider problem understanding, problem formulation, and the potential for long term technology consequences. The potential for revolutionary impact must be evident. The proposal should offer the potential to influence the long-term research agenda in relevant fields. The proposal should pursue theory with an eye toward eventual application. The problem formulation, technical obstacles, and theoretical enablers should be clearly and soundly articulated, and should evidence a refined awareness of wireless networking intricacies. The proposal should evidence awareness of both historical and ongoing related work. Validation of results should be considered. Risks should be appropriately identified, characterized, and mitigated.

INNOVATIVE TECHNICAL SOLUTION TO THE PROBLEM. The objective of this criterion is to establish that innovative and promising approaches are being applied to achieve the objectives of the effort. Offerors should apply new and/or existing theory and practice in an innovative way that supports the objectives of the proposed effort. The proposed approach concepts should show breadth of innovation across all the dimensions of the proposed solution. The theoretical enablers should be traceable to the objectives defined in the proposal.

OFFEROR'S CAPABILITIES, COMMITMENTS, RELATED EXPERIENCE. The objective of this criterion is to establish that the offeror has credible capability and experience to complete the proposed work. The qualifications, capabilities, and demonstrated achievements of the proposed principals and other key personnel for the primary and subawardee organizations must be clearly shown. Moreover, the key individuals must plan to commit sufficient time to the project to ensure its success. The proposers should have a track record of innovation in the relevant disciplines, and should be professionally well-positioned to influence the research agendas of entire disciplines. Proposers should have sufficient professional and research expertise to be able to react appropriately, plan, and re-plan when serendipitous technical advances and negative results arise.

CONSTRUCTIVE PLAN. The objective of this criterion is to establish the viability of the proposed work plan. In contrast to criterion "Innovative technical solution to the problem", this criterion assesses not the technical viability of the proposed technical ideas, but rather the ability of the offerors to effectively carry out the proposed research plan. Roles and responsibilities should be clearly identified. Evaluation will consider the effectiveness of the statement of work, project plan and schedule, team integration, and management plan as they relate to the stated technical objectives and obstacles. The proposed team should be both necessary and sufficient to complete the proposed agenda. Concrete plans for marshalling efforts of the larger community and influencing the research agenda of entire disciplines should be evident. The overall research agenda and timeline, including specific intermediate criteria, should clearly relate to theoretical obstacles that must be overcome. Offerors should specify objective criteria for assessing progress of the team effort in terms of deliverables and intermediate objectives at six-month intervals, as well as the hint of a long-term research agenda for the entire field in terms of major intermediate results needed to achieve longer-term objectives.

POTENTIAL CONTRIBUTION AND RELEVANCE TO DARPA MISSION. The objective of this criterion is to establish a strong link between this work and the DARPA mission. It is NOT necessary that the proposed work be immediately usable in military systems. It is only necessary that this work contribute to technical areas of need by the DOD. The offeror need not focus on military details but may instead clearly address more generally how the proposed effort will advance the DARPA goals of superior and revolutionary insight into the design, planning, and operation of future mobile ad-hoc networks. Evaluation of this criterion will consider factors such as the likelihood of transitioning theory into networking practice, as opposed to evaluating the likelihood of transitioning systems into military practice. Also considered will be impediments to future transition, including intellectual property restrictions.

COST REALISM. The objective of this criterion is to evaluate whether the costs are aligned with the proposed work plan, whether strategies for cost reduction are being employed effectively, and whether the overall cost/benefit ratio is deemed appropriate. The overall estimated cost to accomplish the effort should be clearly shown as well as the substantiation of the costs for the technical complexity described. Evaluation will consider the value to Government of the research and the extent to which the proposed

management plan will effectively allocate resources to achieve the capabilities proposed. Creative approaches to reduce costs by leveraging other ongoing research will be viewed favorably, particularly in support of experimentation. Overall cost is considered a substantial evaluation criterion but is secondary to technical excellence. Unrealistically low cost estimates are as undesirable as unreasonably high costs. In general, the proposal cost should be commensurate with the work effort proposed, adequate detail must be provided to allow proper evaluation of the cost rationale, and cost effective measures must be employed wherever possible.